PATENT COOPERATION TREATY

U 015302-5

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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ELZABURU 2238713 - 23/03/2004 JL

PCT

WRITTEN OPINION
(PCT Rule 66)

(day/month/year) 19.03.2004

Applicant's or agent's file reference	REPLY DUE within 1 month(s) and 15 days from the above date of mailing
PCT-127	

International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/ES 03/00063	03.02.2003	04.02.2002

International Patent Classification (IPC) or both national classification and IPC
C12P23/00, C12P23/00

Applicant
VITATENE, S.A. et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☒	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain documents cited
VII	☐	Certain defects in the international application
VIII	☐	Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 04.06.2004

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I. Basis of the opinion

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed")*:

Description, Pages

1-36 as originally filed

Claims, Numbers

1-26 as originally filed

Drawings, Sheets

1-9 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   ☐ the language of publication of the international application (under Rule 48.3(b)).
   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:
   ☐ the claims, Nos.:
   ☐ the drawings, sheets:

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation (Form PCT/IPEA/405) to restrict or pay additional fees, the applicant has:

   ☐ restricted the claims.

   ☐ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with for the following reasons and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees:

   see separate sheet

3. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this opinion:

   ☒ all parts.

   ☐ the parts relating to claims Nos. .

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1,2,13-16,23,25,26 No
Inventive step (IS)	Claims	1-4,13-16,18-26 No
Industrial applicability (IA)	Claims	

2. Citations and explanations

   see separate sheet

Re Item IV
Lack of unity of invention

U.1 The common concept, which would link the claimed subject-matter together, is the idea of producing astaxanthin by culturing strains of *X. dendrorhous*.

U.1[a] This idea is not novel because the prior art discloses the production of astaxanthin by means of fermentation processes involving strains of *X. dendrorhous* (see for example points 1.5 and 1.6 below).

U.1[b] In addition, this idea does not appear to be novel over the fermentation processes carried out in the presence of *P. rhodozyma* (see for example points 1.1 and 1.2 below) because *P. rhodozyma* and *X. dendrorhous* are the names of the two sexual states of the same microorganism and the distinction between these two yeast forms does not apparently apply to fermentation processes for the production of astaxanthin (see point 1.8 below and the indifferent use of the two names in D5, D6 and D7). Moreover, strains of *P. rhodozyma* are to be considered transformed derivatives of *X. dendrorhous* as defined in the present application (see claim 1).

U.1[c] Hence, the concept above cannot be considered a general inventive concept according to Rule 13.1 PCT, and a lack of unity "a posteriori" is indicated.

U.2 With respect to the problem of improving the fermentative production of astaxanthin in the presence of *X. dendrorhous*, the present application provides the following different solutions:

U.2[a] supplementing duroquinone during the fermentation process (see claims 3-4);

U.2[b] supplementing retinal or trisporic acids for inducing carotenogenesis during the fermentation process (see claims 5-8);

U.2[c] supplementing glutamate during the fermentation process (see claims 9-10);

U.2[d] supplementing the fermentation medium of table I, line 5 (see claims 11-12);

U.2[e] illuminating the fermentation medium (see claims 13-17); and

U.2[f] seeding and cultivating the microorganisms according to the procedure of claim 18 (see claims 18-22).

U.3 Having regards to the technical features which clearly characterize the different solutions, there is no single technical relationship among these solutions involving one or more of said technical features, to which an inventive step could be addressed (Rule 13.2 PCT). Hence, each of these solutions relate to a separate invention or group of inventions.

U.3[a] The fact that all these solutions could account for the improved astaxanthin yield

referred by claims 1 and 2 is not to be regarded as a clear technical feature limiting the claimed subject-matter. By reference to the minimum astaxanthin concentrations, these claims attempt a definition in terms of the result to be achieved, which merely amounts to a statement of the underlying problem (Art. 6 PCT). The technical features necessary for achieving the desired result are to be taken into account (see for example the list of solutions above).

U.4 The separate inventions or groups of inventions are:

U.4[a] Subject 1: claims 1-2(partially),3-4,13-26(partially).
Fermentation processes and products thereof characterized in that duroquinone is added during the fermentation process. Claims 1-2 and 13-26 are partially to be considered within this group in so far as they only involve the addition of duroquinone.

U.4[b] Subject 2: claims 1-2(partially),5-8,13-26(partially).
Fermentation processes and products thereof characterized in that retinal or trisporic acids is/are added during the fermentation process for inducing carotenogenesis. Claims 1-2 and 13-26 are partially to be considered within this group in so far as they only involve the addition of this/these carotenogenesis-inducing agent(s).

U.4[c] Subject 3: claims 1-2(partially),9-10,13-26(partially).
Fermentation processes and products thereof characterized in that glutamate is added during the fermentation process. Claims 1-2 and 13-26 are partially to be considered within this group in so far as they only involve the addition of glutamate.

U.4[d] Subject 4: claims 1-2(partially),11-12,13-26(partially).
Fermentation processes and products thereof characterized in that the specific culture medium of table I, line 5 is used for the fermentation process. Claims 1-2 and 13-26 are partially to be considered within this group in so far as they only involve the use of this culture medium.

U.4[e] Subject 5: claims 1-12(partially),13-17,18-26(partially).
Fermentation processes and products thereof characterized in that the fermentation medium is illuminated during the fermentation process. Claims 1-12 and 18-26 are partially to be considered within this group in so far as they only involve the illumination of the fermentation medium.

U.4[f] Subject 6: claims 1-17(partially),18-22,23-26(partially).
Fermentation processes and products thereof characterized by the specific procedure for seeding and cultivating the microorganisms as described in

claim 18. Claims 1-17 and 23-26 are partially to be considered within this group in so far as they only involve this specific procedure.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. DOCUMENTS.

Reference is made to the following documents:

D1: WO94/23594 A (cited in the International Search Report);
D2: EP438182 A (cited in the International Search Report);
D3: ES 2115637 T (cited in the International Search Report);
D3': EP 551676 A (the corresponding European application);
D4: EP474347 A (cited in the International Search Report);
D5: Cruz J.M. & Parajo' J.C., *Food Chemistry* (1998) vol. 63, no. 4, pages 479-484;
D6: Vazquez M., *Food Technology and Biotechnology* (2001) vol. 39, no. 2, pages 123-128;
D7: Schroeder W.A. & Johnson E.A., *Journal of General Microbiology* (1993) vol. 139, pages 907-912;
D8: EP 1035206 A (cited in the application).

1.1 D1 discloses the production of astaxanthin by means of fermentation processes carried out in the presence of strains of *P. rhodozyma* (see abstract and example 2). In particular, the astaxanthin yield achieved by means of these fermentation processes is higher than 5000 ppm (see tables 1-3).

1.1[a] In addition, D1 discloses methods of increasing astaxanthin production by culturing *P. rhodozyma* strains under light irradiation (see example 6) and the use of UV light as a mutagenesis factor for the selection of the most efficient *P. rhodozyma* strains (see page 9, first paragraph and page 10, second paragraph).

1.2 D2 discloses fermentation methods for the production of astaxanthin by cultivating *P. rhodozyma* strains (see claims 9-11). These methods account for astaxanthin yields higher than 5000 ppm (see table 1, the last three lines).

1.2[a] In addition, D2 discloses the use of UV light for inducing mutations in the yeast strains (see page 3, lines 13-15).

1.3 D3, D3' and D4 disclose *P. rhodozyma* strains for use in the fermentative production of astaxanthin (see abstracts).

1.3[a] In particular, D3 (or D3') teaches that the astaxanthin concentration in the fermentation medium is affected by the illumination conditions during fermentation (see page 2, lines 48-50).

1.3[b] D4 discloses the use of UV light as a mutagenesis factor for the selection of suitable yeast strains (see page 2, line 47).

1.5 D5 discloses a fermentation process for the production of astaxanthin by cultivating *X. dendrorhous* (see abstract).

1.6 D6 discloses the production of astaxanthin by a *X. dendrorhous* strain (see abstract). In particular, the astaxanthin production increases if the microorganism is grown in the light.

1.7 D7 discloses the increased production of astaxanthin by *P. rhodozyma* in the presence of duroquinone (see table 2).

1.8 D8 discloses processes for the production of astaxanthin involving enzymes derived from *P. rhodozyma* (see abstract and claims 9-13). In addition, D8 teaches that the names *P. rhodozyma* and *X. dendrorhous* are used to designate two sexual states of the same microorganism (see page 2, lines 14-16).

2. CLARITY (Art. 6 PCT).

2.1 Claims 1, 2, 12 and 19-22 do not meet the requirements of Article 6 PCT in that the matter for which protection is sought is not clearly defined. The claims attempt to define the subject-matter in terms of the result to be achieved, namely the minimum yield (concentration) of astaxanthin or biomass. In the present case, the reference to the desired result merely amounts to a statement of the underlying problem and the minimum yield is not to be regarded as a clear technical feature limiting the claimed subject-matter. The technical features necessary for achieving the desired result should be added to the definition of the claims (see for example dependent claims 3, 5, 7, 9, 11, 13-17 and 18).

3. NOVELTY (Art. 33(2) PCT) and INVENTIVE STEP (Art. 33(3) PCT).

3.1 The lack of clarity notwithstanding (see point 2.1 above), the subject-matter of independent claim 1 is not novel over D1 and D2 because these documents discloses fermentation processes, which result in the production of astaxanthin at high concentrations (>5000 ppm), and are carried out cultivating strains of *P. rhodozyma* (see points 1.1 and 1.2 above). These *P. rhodozyma* strains are to be considered mutants and/or transformed derivatives of *X. dendrorhous* as defined in the claim because *P. rhodozyma* and *X. dendrorhous* are the names of the two sexual states of the same microorganism (see points 1.8 above). Moreover, the distinction between these two yeast forms does not apparently apply to fermentation processes for the production of astaxanthin (see the indifferent use of the two names in D5, D6 and D7).

3.1[a] The subject-matter of independent claim 1 appears also to lack novelty over D5 and D6, which discloses methods for the production of astaxanthin by cultivating strains of *X. dendrorhous*, i.e. mutants according to the definition of claim 1 (see points 1.5 and 1.6 above). The indication of the desired astaxanthin yield of claim 1 is not to be regarded as a clear feature distinguishing the claimed subject-matter from the methods of D5 and D6 (see point 2.1 above).

3.2 Dependent claims 2-4, 13-16 and 18-22 do not appear to contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, given the disclosure of the prior art.

3.2[a] In particular, the addition of duroquinone to the fermentation medium for increasing the astaxanthin production in cultures of *P. rhodozyma* is disclosed in D7 (see point 1.7 above).

3.2[b] The illumination of the yeast culture during fermentation has been already applied/described in the prior art for increasing astaxanthin production (see points 1.1[a], 1.3[a] and 1.6 above).

3.2[c] The specific seeding and culturing procedure of dependent claim 18 has not been disclosed in the available prior art, and therefore the subject-matter of claims 18-22 is considered to be novel. Nevertheless, it consists of procedural steps which come within the customary practice followed by the skilled person. The temperature conditions, seeding concentrations and time intervals disclosed/suggested in the prior art for cultures of *X. dendrorhous* and *P. rhodozyma* do not significantly differ from the ones defined in claim 18 (see D1-D7). Moreover, no unexpected effect (e.g. improved astaxanthin yield with respect

to D1-D7) is apparently achieved following this specific seeding and culturing procedure.

3.3 The subject-matter of claims 23, 25 and 26 is not novel over the fermentation cultures which are disclosed in the prior art and comprise *X. dendrorhous* or *P. rhodozyma* strains for the same reasons mentioned above (see point 3.1). D1 and D2 disclose the use of such a fermentation product in the food industry (see for example: D1; abstract and examples 10-11; D2, page 2, lines 11-20 and paragraph joining pages 5-6).

3.3[a] Dependent claim 24 does not appear to contain any features which, in combination with the features of claim 23 to which it refers, meet the requirements of the PCT in respect of novelty and/or inventive step, given the disclosure of D1 and D2.

3.4 The subject-matter of claims 5-12 and 17 appears to be novel and to involve an inventive step over the available prior art as explained below.

3.4[a] Following the reasoning of points 3.1 and 3.1[a] (see above), D1, D2, D5 and D6 can be independently considered to represent the relevant state of the art (see also points 1.1, 1.2, 1.5 and 1.6 above).

3.4[b] The problem to be solved can therefore be regarded as the provision of alternative and improved fermentation processes for the production of astaxanthin in the presence of yeast strains derived from *X. dendrorhous*.

3.4[c] The solutions proposed in dependent claims 5-12 and 17 consist in: (i) the addition of one substance among retinal, trisporic acids and glutamate during the fermentation process, or (ii) the use of the specific fermentation medium of table I, or (iii) the exposure of the fermentation medium to cycles of illumination/darkness.

3.4[d] These substances, fermentation medium and cycles of illumination/darkness distinguish the claimed subject-matter from the prior art. Hence, novelty is acknowledged.

3.4[e] Moreover, none of these solutions has been suggested in the prior art for solving the problem posed, and therefore inventive step is also acknowledged.

3.4[f] The subject-matter of these claims is to be considered as involving an inventive step also in the light of the unexpected and improved astaxanthin yield, which is achieved by applying any of these solutions (see examples 8-10 and figures 6, 7 and 8b of the present application). In particular, the cyclic illumination protocol of claim 17 account for a higher astaxanthin yield than the continuous illumination of the yeast cultures described in the prior art (see example 10 and figure 8b).

4. INDUSTRIAL APPLICABILITY (Art. 33(4) PCT).

4.1 Claims 1-26 relates to fermentation methods and products, which can be applied/made in the food industry, hence the subject-matter of these claims is to be considered industrially applicable according to article 33(4) PCT.